

persal of mammalian groups, and how profoundly even the present discoveries have modified our conceptions of the past history of the mammalia and of the globe in general.

After a careful study of the volume before us, we have found no occasion for a single word of hostile criticism. The author knows his subject from every possible point of view in a most thorough manner, and has treated it in a thoroughly philosophic way from first to last, while the introduction is written in a style that will appeal to the general reader as well as to the specialist. It is, perhaps, not too much to say that it is the most important contribution to mammalian palæontology that has ever appeared within our own recollection on this side of the Atlantic, and if the twentieth century were to see no other work on mammals—either recent or fossil—it would still have a vast achievement to its credit.

R. L.

### THE CALIFORNIAN EARTHQUAKE OF APRIL 18.

THE accounts which are reaching this country enable us to form a better idea of the character of the Californian earthquake of April 18 last than could



FIG. 1.—The Burning of the Business District of San Francisco after the earthquake on April 18. From the *Scientific American*.

be done from the telegraphic reports of the daily papers, and one of the most striking facts which stand out is the wonderfully small amount of damage done in San Francisco by the earthquake proper. This does not seem to have exceeded the sixth or seventh degree of the Rossi-Forel scale, and the damage to buildings was practically confined to the overthrow of chimneys and of buildings which were either old and badly constructed, or of a design which rendered them especially liable to earthquake damage. The *Scientific American* of May 12 contains a view of the business part of the city, taken after the earthquake, but before the spread of the fire, in which the buildings show little signs of damage, beyond the overthrow of some of the chimney stacks. Where the city was built on made ground settlements and disturbances of ground level led to fractures of the water-mains, but it is not clear from the accounts which have reached us whether there was not also an interruption of the main conduit at some point between the city and the source of supply. Whatever the cause, the conse-

quences of the failure of water were disastrous, and the fire, started by the earthquake, was able to spread unchecked.

Apart from the loss of buildings and lives, San Francisco has lost its most important libraries and scientific collections; the Bancroft library of books and manuscripts relating to the history of the Pacific coast has been saved, as have most of the type-specimens of plants in the collection of the Academy of Sciences, but that is practically all. On the other hand, the Lick Observatory and the University of California have escaped damage, and the working part of the Leland-Stanford University has escaped the complete destruction which has been the fate of the memorial buildings of that institution.

The area over which the earthquake did serious damage was confined to a narrow strip of country extending from the town of Ukiah, on the Russian river, to the town of Salinas near Monterey Bay. Beyond these limits the country is sparsely settled and may have been vigorously shaken without the fact being reported, but the limits indicated lie about 205 miles apart, or 125 miles north and 80 miles south of San Francisco; within this strip the damage was very capriciously distributed, and died out rapidly to the east and westwards; at Berkeley town many buildings were ruined, but the University of California

escaped; San Jose was partly ruined, and most of the buildings of the Stanford University, at Palo Alto, were destroyed, but the Lick Observatory, about fifteen miles to the eastward, was uninjured, nor is any serious injury reported from the towns on the coast. These peculiarities in the distribution of the earthquake damage are explained in an article on the probable cause of the San Francisco earthquake by Mr. Frederick Leslie Ransome, published in the May number of the *National Geographic Magazine*. The article is illustrated by a very clear structural map of the San Francisco peninsula, and an equally clear description of the structural conditions of the region. Probably nowhere in the world have greater displacements taken place in geologically recent times than this district has witnessed; strata of Quaternary age have here been compressed, contorted, and lifted from 1500 to 2000 feet, and right

through the peninsula run three nearly parallel faults, two of which, the Pilarcitos and San Andreas faults, are marked by lines of pools and lakes, proving the recent date of the disturbance to which they owe their origin. The third fault, known as the San Bruno fault, is the most important of the three; it has a throw of more than 7000 feet near San Francisco, and has been traced, with more or less certainty, from Point Arenas, 100 miles to the north-west, through Southern California, where it is known as the "earthquake crack," almost to the Gulf of California. A movement along this fault, and others parallel to it, appear to have been the cause of the earthquake, or at any rate of the curious localisation of damage noticed above. The San Bruno fault passes close to the Stanford University and to the city of San Jose, and crosses the main line of water-supply from the Crystal Springs reservoir to the city of San Francisco; it is, presumably, along this fault that the displacement reported in the newspapers took place. There are indications,

too, of another fault running along the eastern margin of the bay through Santa Rosa and north-westwards along the valley of the Russian river past Ukiah, which may have been concerned in the violence of the earthquake at those places.

Two other articles in the same magazine deal with the times at which the disturbance was recorded by seismographs. From them we gather that the shock was recorded on a self-registering seismograph in the University of California at 5h. 12m. 38s. a.m. Pacific time, equivalent to 1h. 12m. 38s. p.m. Greenwich time. The seismograph of the United States Weather Bureau at Washington, 2435 miles distant from San Francisco, recorded the commencement at 8h. 19m. 20s. eastern time, corresponding to 1h. 19m. 20s. Greenwich time, and the seismographs of the United States Coast and Geodetic Survey at Sitka, Alaska, and Cheltenham,

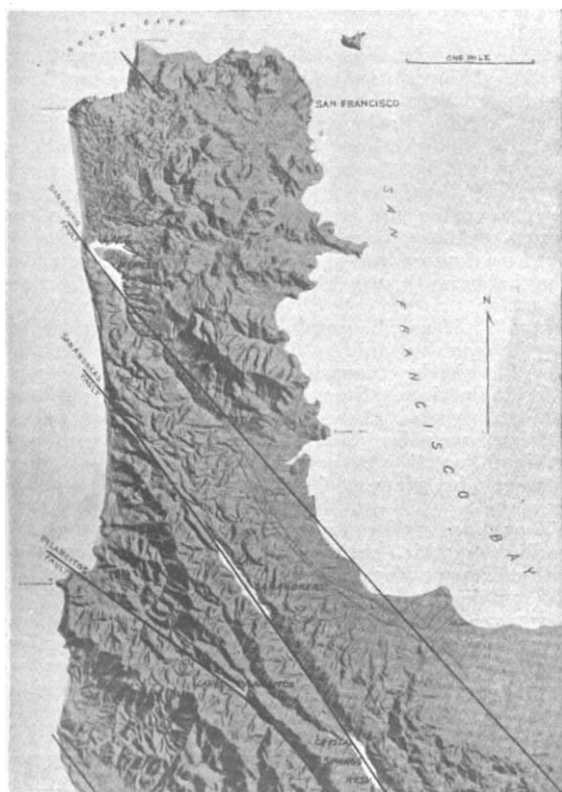


FIG. 2.—Map of the San Francisco Peninsula. From the model by Prof. A. C. Lawson. The principal faults are indicated by heavy black lines. From the *National Geographic Magazine*.

ham, Maryland, also recorded the shock, commencing at 1h. 16m. 56s. and 1h. 19m. 24s. respectively, the distances from San Francisco being 1455 and 2450 miles. The magnetographs at these two places and at Baldwin, Kansas, were also affected by the passage of the earthquake waves, the times corresponding approximately with those of the arrival of the principal, or third, phase of the disturbance.

#### THE FORTHCOMING MEETING OF THE BRITISH ASSOCIATION AT YORK.

THE arrangements for this meeting, which will be held from August 1 to August 8, are very well in hand, being at least a month in advance of what they were twenty-five years ago, on the occasion of the jubilee meeting—one of the most

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successful ever held. The local fund now reaches more than 3000l., and the greater part having been already paid up, the fund has been closed. The various committees are meeting regularly, secure good attendance, and the greatest interest and enthusiasm prevails. One of the local secretaries, Mr. Dale, having died, Mr. Henry Craven, who has succeeded him in the office of town clerk, has been appointed his successor.

The following is an epitome of the general attractions included in the programme:—

*Wednesday, August 1.*—The Lady Mayoress (Mrs. R. H. Vernon Wragge) will be "At Home" at the Mansion House from 3 p.m. to 6 p.m. to receive foreign visitors, members, associates, and lady ticket-holders. President's address in the exhibition buildings at 8.30 p.m.

*Thursday, August 2.*—The Sheriff of York and Mrs. Bentley will give a garden-party at their residence, Fulford Grange, to all ticket-holders, from 3 p.m. to 6 p.m. Conversazione in the exhibition buildings, by invitation of the executive committee, at 8 p.m. Music will be provided in the museum gardens, which communicate with the building and will be illuminated.

*Friday, August 3.*—Messrs. Rowntree and Co. will give a garden-party at their works, Haxby Road, to all ticket-holders, from 3 p.m. to 6 p.m. The works will also be open. Discourse on volcanoes, by Dr. Tempest Anderson, in the exhibition buildings at 8.30 p.m.

*Saturday, August 4.*—The Archbishop of York and Mrs. MacLagan will give a garden-party at the Palace, Bishopthorpe. Evening lecture to the operative classes by Prof. Silvanus Thompson, F.R.S., on the manufacture of light. The president, Prof. Ray Lankester, will take the chair.

*Sunday, August 5.*—Special service in the Minster.

*Monday, August 6.*—The council of the Yorkshire Philosophical Society will give a garden-party in the museum grounds, to all ticket-holders, from 3 p.m. to 6 p.m. They have also intimated that the museum and grounds will be open daily to all members and ticket-holders who wish for a quiet resting-place. The president of the society, Dr. Tempest Anderson, will entertain to tea those who attend each afternoon. Discourse on the electrical signs of life, and their abolition by chloroform, by Dr. A. D. Waller, F.R.S., in the exhibition buildings, at 8.30 p.m.

*Tuesday, August 7.*—The Dean of York and the Canon in Residence will give a garden-party, to all members and ticket-holders, in the Deanery and residentiary grounds, from 3 p.m. to 6 p.m. Conversazione in the exhibition buildings, by invitation of the executive committee, at 8 p.m. Music will be provided in the museum gardens, which will be illuminated.

*Wednesday, August 8.*—Meeting of general committee to receive the report of the committee of recommendations, 1 p.m. Concluding general meeting, in the Guildhall, at 2.30 p.m.

It is understood that a large number of important papers has been already promised, and it will be noticed that an unusually attractive series of garden-parties and receptions has been provided. In fact, the number offered has been so large that several very eligible offers of hospitality have had to be reluctantly declined. Practically all the principal residents in York and the neighbourhood have invited members of the association for the time of the meeting, besides a large number of private friends; who will swell the lists of members and associates attending.

The proposed excursion to Norway at the close of the meeting has fallen through, as little interest or support seemed forthcoming. The excursions will therefore be confined to Saturday, August 4, and the following have been definitely fixed:—

Scarborough and Whitby, stopping at Castle Howard.—The Mayor of Scarborough has intimated that he will be "At Home" to a limited number of those taking part in the excursion. Permission has been granted to view the Marine Drive, and the members and associates will be